

REMARKS

It is noted that the claim amendments herein are intended solely to more particularly point out the present invention for the Examiner, and not for distinguishing over the prior art or the statutory requirements directed to patentability.

It is further noted that, notwithstanding any claim amendments made herein, Applicant's intent is to encompass equivalents of all claim elements, even if amended herein or later during prosecution.

Claims 1-20 are all of the claims pending in the present Application. Claims 1-4 and 7 stand rejected under 35 USC §102(e) as anticipated by US Patent 6,272,439 to Buer. Claims 9-12,14, and 16 stand rejected under 35 USC §102(e) as anticipated by US Patent 6,476,632 to La Rosa et al. Claim 5 stands rejected under 35 USC §103(a) as unpatentable over Buer, further in view of US Patent 5,448,205 to Rothermel.

Claim 6 stands rejected under 35 USC §103(a) as unpatentable over Buer. Claim 13 stands rejected under 35 USC §103(a) as unpatentable over La Rosa. Claims 8, 15, and 17-20 stand rejected under 35 USC §103(a) as unpatentable over La Rosa, further in view of Buer.

These rejections are respectfully traversed in view of the following discussion.

I. THE CLAIMED INVENTION

As described and exemplarily defined by claim 1, the present invention is directed to a ring oscillator including an odd number of elements interconnected in a serially-connected infinite loop. Each element has an associated delay unit. Each delay unit has a programmable delay.

A key advantage of the present invention, as exemplarily defined by claim 1 and as shown in Figure 13, is that duty factor can be varied without affecting frequency. Changing duty factor while keeping frequency constant is an important aspect in measuring circuit degradation due to the NBTI mechanism.

II. THE PRIOR ART REJECTIONS

The Examiner alleges that claims 1-4 and 7 are anticipated by Buer and that Buer renders obvious claim 6 and, when combined with Rothermel, renders obvious claim 5 and, when combined with La Rosa, renders obvious claims 8, 15, and 17-20.

However, Applicants disagree that the Examiner properly interprets the wording of claim 1 in the rejection currently of record. That is, a distinguishing feature of the first exemplary embodiment shown in Figure 12 is that, for each of the serially-interconnected elements (e.g., the buffer amplifier 122, there is an associated delay unit (e.g., label 125) connected in parallel to the serially-interconnected element.

In contrast, Figure 4 of Buer shows serially-interconnected delay cells 104, 106, 108, 110. The delay cells are shown in Figure 2. It is clear from Figure 2 that each delay cell 200 includes a delay block 202 and a mux 204. It is also clear that the delay block 202 incorporated in the serially-interconnected delay cells 104-110 do not have a programmable delay. That is, it is clear that the programmability of delay in Buer depends upon using the mux 204 to either switch the delay block 202 into or out of the serial interconnection.

Applicants have amended claim 1 to clarify for the Examiner's benefit that it is the delay unit associated with the serially-interconnected element that is programmable, thereby precluding the Examiner's seeming interpretation that the serially-interconnected element has an associated programmable delay.

Thus, the present invention incorporates a delay element in parallel with the amplifier stages. This feature allows the present invention to vary duty factor while keeping frequency constant. This capability is very important to measuring circuit degradation due to the NBTI mechanism, as mentioned in the penultimate sentence in paragraph [0075] on page 12 of 48 of the electronically-filed version.

Hence, turning to the clear language of the claims, there is no teaching or suggestion of “... each said element having an associated delay unit, each said delay unit having a programmable delay”, as required by claim 1.

None of the cited prior has this capability. That is, contrary to the Examiner's characterization relative to claim 5, Buer is not at all "silent" about duty factor. The simple multiplexer switching of Buer is incapable of adjusting duty factor. Therefore, the Examiner

is not justified to attempt another reference (e.g., Rothermel) to modify Buer, since such modification would clearly change the function, the principle of operation, and the purpose of the Buer ring oscillator. Such modification or combination, as urged by the Examiner, would be improper under MPEP §2143.02. Therefore, Rothermel is irrelevant to the evaluation, since it cannot be combined with Buer to overcome the deficiency identified above.

For this reason alone, the claimed invention as defined by claims 1-8 is fully patentable over Buer.

Relative to the rejection based on La Rosa, Applicants point out that the La Rosa test technique is designed to test both the PMOSFET and the NMOSFET, as the Examiner concedes.

In contrast, the present invention is designed to measure NBTI and has only the target PFET as the subject of the test. The rest of the circuit in the present invention is designed specifically to eliminate any possible hot carrier induced effects in the pass gates or in the NFET pull down on the amplifier stage.

Only in this way can the NBTI effect on the target PFET be unambiguously characterized. Without this characteristic, the circuit is not useful as an in-line monitor, since process experiments to quantify NBTI (by delta frequency) could be corrupted by hot carrier effects in NFETs. This aspect of the present invention is discussed beginning at paragraph [0101] on page 16 of 48 of the electronically-filed version.

Hence, turning to the clear language of the claims, there is no teaching or suggestion of: "... said target PFET being integrated into said ring oscillator in such configuration that hot carrier effects from other components in said test circuit do not affect said NBTI effect ...", as required by claim 9.

Relative to claim 14, there is no teaching or suggestion of: "... measuring at least one characteristic of said ring oscillator based on independently controlling both a frequency parameter and a duty factor parameter of said ring oscillator."

For the reasons stated above, the claimed invention as defined by claims 1-20 is fully patentable over the cited references.

Further, the other prior art of record has been reviewed, but it too, even in combination with Buer, La Rosa, or Rothermel, fails to teach or suggest the claimed invention.

III. FORMAL MATTERS AND CONCLUSION

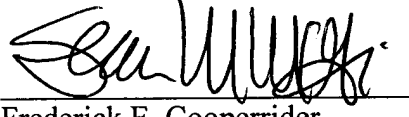
In view of the foregoing, Applicant submits that claims 1-20, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Assignee's Deposit Account No. 09-0456.

Respectfully Submitted,

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